

Tucumcari Project

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Tucumcari Project

The Tucumcari Project diverts water from Conchas Lake through a distribution system to potential agricultural land in the Tucumcari area in Quay County, New Mexico. As a water project it was unique in that it was a work relief project during the Great Depression and an emergency food project during the Second World War. The project had been made possible by Conchas Dam, which the Army Corps of Engineers built for flood control and storage on the South Canadian and Conchas rivers. Conchas and Hudson canals have a combined length of 110 miles and the capacity to divert 300,000 acre feet of water annually. Although originally authorized to irrigate about 45,000 acres, the Tucumcari Project irrigates closer to 34,000 owing primarily to low water availability due to drought and leakage in the distribution system.¹

Project Location

The Tucumcari Project is located in the high desert of northeastern New Mexico. Although the Conchas Dam and much of Conchas Canal are in San Miguel County, all of the project land lies within Quay County. The county seat is the city of Tucumcari, founded in 1901 and situated on Route 66 about 180 miles east of Albuquerque, New Mexico, and 110 miles west of Amarillo, Texas. To the west and the south of Tucumcari is the Pecos River, which originates in the Sangre de Cristo Mountains of north-central New Mexico and flows south until it meets the Rio Grande. The South Canadian River also originates in the Sangre de Cristo Mountains and runs in a general easterly direction

¹ United States Department of the Interior, Water and Power Resources Service, *Project Data* (Denver: United States Government Printing Office, 1981), 1229-32; “Arch Hurley Water Users,” <http://www.archhurley.com/> (accessed April 17, 2008); Franklin McCasland, manager of the Arch Hurley Conservancy District, Tucumcari, New Mexico, conversation with the author, April 21, 2008.

through northeastern New Mexico, the Texas panhandle, and Oklahoma where it joins the Arkansas River. Water in the project area is usually in short supply. Average annual rainfall is 16 inches—most during the monsoon season—but precipitation is erratic and departures from the average are very common.

Historic Setting

The story of how Tucumcari received its name is oft told but historically suspect. According to the legend, the aged Apache Chief Wautonomah was troubled by the question of who would succeed him as ruler of the tribe. He offered to settle the question through a contest to the death between two rivals, Tonopah and Tocom. After Tonopah took Tocom's life, Kari, the chief's daughter who loved Tocom, used a knife to take Tonopah's life as well as her own. When Chief Wautonomah saw the bodies of Kari and two braves, he took his daughter's knife and drove it into his own heart, crying out, "Tocom-Kari!" Some attribute the origin of the name to this tragic love tale, but more likely the name is a derivation from the Comanche word *tukanukaru*, which means to lie in wait for something. Comanche actually used the nearby mesa as a Comanche lookout point many years ago.²

Whatever the origins of the name, Tucumcari has had a long human history. Before European contact, ancient and modern Indian cultures occupied present-day northern New Mexico and southern Colorado. The Anazasi established a vast cultural zone between 700 and 1300 a.d. that reached as far east as the Canadian River in northeastern New Mexico. The Anazasi and, later, Pueblo Indians congregated primarily

² "Tucumcari, New Mexico," Wikipedia, <http://en.wikipedia.org/wiki/Tucumcari> (accessed February 20, 2008).

where there was a dependable supply of water that made it possible to cultivate maize, various types of greens, and squash on small farm plots. On the heels of the Anazasi were the Jicarilla Apache, one of six groups of Southern Athapaskans who migrated into the Southwest between 1300 and 1500 a.d. For sustenance they primarily hunted game and gathered berries, nuts, and seed-bearing grasses, but they also farmed maize, melons, squash, and beans at least since the late seventeenth century. Unlike other Indian cultures, Jicarilla men prepared the fields, irrigated, and helped the women to harvest the crops.³

The Spanish established missions and permanent settlements along the Rio Grande, Pecos, and the upper reaches of the Mora and Canadian rivers where there were reliable sources of water. The area and surrounding Tukumcari was originally a Spanish land grant for cattle ranching but is now the Bell Ranch. According to the ranch manager at the time of the project's construction, "The Bell Ranch was established on two contiguous grants of land, the principal one of which is known as the Pablo Montoya Grant, from the name of the grantee to whom it was conveyed by the Spanish provincial authorities in 1824." In the early 1800s, however, there were few Spanish settlements close by to protect the livestock from marauding Indians, so it is unlikely that the Spanish ever stocked the land with cattle.⁴

Cattle came later in the nineteenth century with the arrival of Anglo Americans. Wilson Waddingham reportedly took possession of virtually the entire grant, as well as an adjoining tract known as Baca Location No. 2. Bell Ranch probably dates from about

³ Alfonso Ortiz, ed., *Southwest*, Vol. 10, of *Handbook of North American Indians*, William C. Sturtevant, ed. (Washington, D.C.: Smithsonian Institution, 1983), 440-41.

⁴ "Conchas Dam and Proposed Tukumcari Project," *Reclamation Era*, Vol. 29 (June 1939): 126; H. E. Robinson, "Tukumcari Tunnel Construction," *Reclamation Era*, Vol. 32 (January 1942): 11.

1872; in 1899 the Red River Valley Company organized to manage the ranch. At the height of its holdings, the ranch possessed 719,000 acres of land and 22,000 head of cattle.⁵ Homesteaders at the turn of the century attempted to dry farm in the region but gave that up after successive failures. Most farmers divested their holdings to ranchers, except for some men on Ute Creek who hoped that irrigation would one day make farming profitable.⁶

Settlers and boosters knew that irrigation was essential for agriculture in northeast New Mexico and just about anywhere else in the American Southwest. The South Canadian River and its tributaries provided a reliable source of water but there were always the problems of drought, flooding, and poor water quality.⁷ The 1888-89 drought is best known for the number of cattle that died on the range, but other dry spells over the last century have been almost as severe. Flooding has long been a major concern; in 1904, a flood raged through nearly the entire course of the river, “sweeping everything from its path and covering the valley with sand from one-half to four feet in depth, completely obliterating everything in the form of vegetation.” Losses from that flood totaled an estimated \$3.6 million dollars.⁸

⁵ Robinson, “Tucumcari Tunnel Construction,” 11.

⁶ John P. Woodward, “Tucumcari’s Champions,” *Reclamation Era*, Vol. 33 (August 1947): 183.

⁷ The rivers of New Mexico are well known for their poor water quality and low flows due partly to high concentration of saline brine and the infestation of phreatophytic nonnative plants like the saltcedar. Native Americans are said to have complained “about the effects of Pecos water on the human digestive system.” As Lieutenant S. G. French of the U.S. Corps of Topographical Engineers described it in 1849, “It is a narrow deep stream, its waters turbid and bitter, and ... [it carries] more impurities than any other river of the south. The only inhabitants of its waters are catfish.” Quoted in R. Jensen, C. Hart, M. Mecke, and W. Hatler, *The Influence of Human Activities on the Waters of the Pecos Basin of Texas*, TWRI technical report SR-2006-03, 2006, 8 (cited in Campbell, 1958).

⁸ “Flood on the South Canadian River, in Oklahoma and Indian Territory, October 1-4, 1904,” *Monthly Weather Review*, (November 1904): 522.

Investigations

The soil on the land surrounding Tucumcari is ideal for growing crops and produce, but no farming can take place without irrigation. The first surveys for potential irrigation works on the Canadian River and its tributaries were made in 1910-11 by the Interstate Land and Development Company on the potential for irrigation on Ute Creek near Logan, New Mexico. The next year, W. B. Freeman conducted surveys on Ute Creek and Pajarito Creek for a reservoir and canal system to serve 30,000 acres of land in the Tucumcari area. In 1911 he filed for the water, which was approved by the territorial engineer of New Mexico, but the project he envisioned did not come to fruition at that time because of lack of funds.⁹

In 1918 General George W. Goethals, Chairman and Chief Engineer of the Isthmian Canal Commission (I.C.C.) and later governor of the Panama Canal, visited Santa Fe with the view of developing the Canadian River. Goethals traveled with Royal A. Prentice to inspect the Canadian River and “offered an opinion that a site on the Canadian just below its confluence with the Conchas river [sic] appeared best suited for a dam.” The site he selected became the site of Conchas Dam nearly two decades later. In 1920 a visit to the region by John Morrow of Raton—lawyer, educator, and later United States Representative from New Mexico—generated additional interest in a water project. Morrow was instrumental in convincing the Corps of Engineers to sponsor such a project.¹⁰

⁹ “Project History, Tucumcari Project,” Vol. 1, 1939, 11-12, in Record Group 115, Records of the Bureau of Reclamation, Entry 10, Box 565, National Archives and Records Administration, Denver, Colorado; hereafter cited as RG 115; Woodward, “Tucumcari’s Champions,” 183-4.

¹⁰ Woodward, “Tucumcari’s Champions,” 184.

The next major steps toward development of the water of the Canadian River and its tributaries came in 1925 with the organization of the Canadian River Development Association. The major purpose of this association was to broker a Canadian River interstate compact among New Mexico, Texas, Oklahoma, and Arkansas for flood control and irrigation. The U.S. Geological Survey mapped the area and completed their topographic survey in 1928, and the state engineer of New Mexico completed his survey and report on the Pajarito Creek project in 1929. In the wake of the Mississippi River flood of 1927, the federal government also investigated a large-scale flood control program in the lower Mississippi River basin. In 1930 the Corps of Engineers reported unfavorably on a flood control project on the Canadian River, but that was overturned in the “308 reports” on the Arkansas River basin.¹¹ The federal government initiated and authorized the dam with passage of the Emergency Relief Act of 1935 and the Flood Control Act of June 1936.¹²

Way back in 1904 Reclamation did a reconnaissance of the Canadian River and briefly mentioned the possibility of a reservoir near Tucumcari in its third annual report, but, aside from that, not until 1936 did Reclamation have any serious discussion about irrigation works in the Tucumcari vicinity. First, in 1936, it conducted a reconnaissance survey, then a more detailed investigation later in the year, surveying the proposed

¹¹ “Project History, Tucumcari Project,” Vol. 1, 1939, 12-13, 15, in RG 115, Entry 10, Box 565; Woodward, “Tucumcari’s Champions,” 184.

¹² “Conchas Dam and Proposed Tucumcari Project,” *Reclamation Era* (June 1939): 126. Section 8 of the Flood Control Act of 1944 authorized the Department of Interior, acting through the Bureau of Reclamation, to contract on behalf of the Government for repayment of benefit costs over and above costs allocated to flood control on projects constructed by the Corps of Engineers.

location of the main canal and potential farm land and developing cost estimates. Its findings became the basis for the project's eventual authorization in 1938.¹³

For a short time in the 1940s, Reclamation also seriously investigated enhancing the city of Tucumcari's municipal water supply. Heavy pumping of city wells had created a water crunch for the small, yet growing, community. To alleviate the need, the city would tap into water from Pajarito Creek and Blanca Creek, where diversion dams, a canal, and a pipeline from a purification plant to the city's main water line would provide the much needed water to the city. The idea to have Reclamation construct this project was still on the table in 1945, "owing to the close relationship between the interests of the city of Tucumcari and the Tucumcari project [sic]," but it was modified to divert water to the city directly from Conchas Reservoir instead of storing it behind diversion dams. That would mean a "reduction of the number of acres of farmland irrigated by Conchas water."¹⁴

Authorization

In the spring of 1937, a group of businessmen in the Tucumcari area organized the Arch Hurley Conservancy District.¹⁵ That summer, a federal act authorized

¹³ "Project History, Tucumcari Project," Vol. 1, 1939, 15-16, 28, in RG 115, Entry 10, Box 565; H. W. Mutch, "Preconstruction Investigations—Tucumcari Project, New Mexico," *Reclamation Era*, Vol. 30 (September 1940): 270.

¹⁴ U.S. Department of Interior, Bureau of Reclamation, "Water Supply Project, City of Tucumcari, New Mexico," September 1943, 2-3, 9, 10, in Record Group 115, Records of the Bureau of Reclamation, Project Reports 1910-55, Box 834, National Archives and Records Administration, Denver, Colorado; Construction Engineer to Commissioner of Reclamation, March 9, 1945, report of newspaper clipping from the Tucumcari Daily News, in Record Group 115, Records of the Bureau of Reclamation, Entry 7, Box 1136, fld. "Tucumcari Clippings, September 1944 Thru," National Archives and Records Administration, Denver, Colorado.

¹⁵ A bill before the New Mexico legislature to change the name of the district to the Tucumcari Conservancy District had been pre-approved by Reclamation and members of the conservancy board. It never passed, likely because some feared the change of name would interfere with existing project contracts. See fld. "Names of Projects, Divisions, & Features," in RG 115, Entry 7, Box 1137.

Reclamation to use some of the impounded water at Conchas Reservoir for irrigation at Tukumcari with the project to be operated and repaid by the conservancy district. The following spring, Congress authorized the Bureau of Reclamation to enter into a contract with the conservancy district for construction of the Tukumcari Project. Since there were no New Mexico state laws permitting a conservancy district to enter into a contract with the federal government, a state law, Senate Bill No. 133, passed in spring 1939 to legalize the contract.¹⁶

The project, as authorized, provided for the irrigation of 45,000 acres of farmland using about 135,000 acre-feet of water from Conchas Reservoir. The cost of the project was more than the conservancy district could repay. Of the \$2.5 million non-reimbursable costs, some of that would be funded by the Works Progress Association (WPA), the New Deal's largest relief program; the balance of \$5,655,000 was reimbursable, to be repaid by the district over a forty-year period. It was hoped that upward of 500 to 600 families would eventually settle on project land and that just as many more would establish homes and businesses in the city as direct beneficiaries of the federal water project.¹⁷

Construction History

Conchas Dam and Reservoir

Although Conchas Dam was not a Reclamation project, it made the Tukumcari Project possible. Designed and constructed by the Corps of Engineers, the dam—at a height of 235 feet and crest length of 6,230 feet, with a storage capacity of 528,951 acre feet—was an imposing presence near the confluence of the Canadian and Conchas rivers.

¹⁶ “Project History, Tukumcari Project,” Vol. 1, 1939, 16-18, in RG 115, Entry 10, Box 565.

¹⁷ “Project History, Tukumcari Project,” Vol. 1, 1939, 17, 24, in RG 115, Entry 10, Box 565.

Using the height of the reservoir as scale, the lower 100 feet was to be used for dead storage, the next forty-six feet for conservation and irrigation, and the remaining capacity for flood control. Conchas Dam was first multi-purpose dam constructed by the Corps.¹⁸

Bent Brothers, Inc., and Griffith Co., of Los Angeles received the contract for the main dam and wing dams for a low bid of just over \$4.5 million. Ernest W. Everly of Albuquerque received the contract to construct the emergency spillway. The main structure is a gravity-type concrete dam, which means it is not arched and therefore relies entirely on its bulk to prevent failure under the weight of its load. For its size, it required a lot of concrete. On April 12, 1937, a ceremony commemorated the first placement of concrete; over the next several years, about 750,000 cubic-yards of it would be laid.¹⁹ Contractors built a 300-foot service spillway at the center of the dam, stilling basins, and penstocks “to provide outlets for possible future use of impounded water for municipal water supply and electric power generation.” Construction also proceeded on two earth-fill wing dams flanking an emergency spillway one mile north of the main dam, and one wing dam south of the main dam.²⁰

In addition to the main dam, stilling basins, penstocks, and wing dams, and in anticipation of an irrigation program, the Corps constructed irrigation headworks. McCarthy Improvement Co. of Davenport, Iowa, received the contract to construct the tunnel for \$307,107.25, and Bent Brothers, Inc., and Griffith Co. received the contract for installation of gates and operating equipment for \$123,910.40. The headworks consisted

¹⁸ Water and Power Resources Service, *Project Data*, 1229; for a history of the Corps involvement in water projects, see United States Department of the Interior, Bureau of Reclamation, National Park Service, and United States Department of the Army, Corps of Engineers, *The History of Large Federal Dams: Planning, Design and Construction*, by David P. Billington, Donald C Jackson and Martin V. Melosi (Denver: Bureau of Reclamation, 2005).

¹⁹ “Project History, Tucumcari Project,” Vol. 1, 1939, 7, in RG 115, Entry 10, box 565.

²⁰ “Conchas Dam,” 127.

of a concrete-lined tunnel, nearly 700 feet long running under the south dike, and an outlet portal where water would be released into the irrigation canal. Construction on the headworks began in October 1938; at the end of April 1939, the dam and other appurtenant works stood at 95 percent completed, at a total cost of about \$16,000,000.²¹

Tucumcari Project

For its first 38 miles, the Conchas Canal parallels a high mesa through the Bell Ranch in a southeasterly direction, and once entering Quay County continues south and southeast into the project lands. Construction of the gravity canal was no simple task given the broken landscape. Contractors needed to construct several tunnels through high-level mesas, line the canal with concrete where seepage was particularly acute, and build about thirty siphons where the canal crossed the numerous arroyos and gullies in the area. Reclamation also faced the fairly complex assignment of determining rights-of-way, water rights, and classification of project lands, and establishing legal contracts with the city, the railroad company, and other entities. It was a fairly large undertaking that stretched out over a decade.

The resident engineer was Harold W. Mutch, a man who had several decades of engineering experience at Reclamation. Of Mutch's attributes, Murray L. Crosse noted that he was no doubt a competent engineer but that he wrote "weak memos," failed to "follow through," and, though agreeable, commanded little respect from his subordinates. In Crosse's opinion, "he is not fitted or qualified by experiences, resourcefulness, ability, initiative and capacity to command, direct and control a project organization in a manner

²¹ Ibid., 127, 129.

which will meet Bureau standards and the Bureau's usual reputation with the public and other Government agencies.”²²

Crosse's critical comments were made in the context of an investigation into the management of the project and conduct of some of its officers. In his brief investigation in September 1940 he interviewed a handful of men working on the project and drew up a report to the Commissioner of Reclamation John C. Page. One guard at the Conchas Dam camp when it was run by the Corps and then by Reclamation, observed in 1940 that “more people appeared to get drunk in the area after the Camp was taken over by the Bureau of Reclamation early this year.” He then proceeded to describe the “boisterous and noisy” parties at the homes of associate engineer Herbert E. Robinson and assistant engineer L. C. Matthews. Robinson had apparently used government vehicles for private business and several times ignored requests to enhance safety measures at the work sites. Assistant engineer Charles L. LeFeber repeatedly spoke with Robinson about “the need for seats in trucks and other safety regulations” and the proper storage of dynamite caps, but Robinson did nothing. LeFeber concluded that “not only did [I] not have the cooperation of Mr Robinson on safety matters but that ~~he was~~ I had his opposition to safety measures to contend with.” The contractor had allegedly cut corners on the Conchas Division at the hazard of workers' safety and professional workmanship.²³

The Crosse report seemed to indicate that major changes to the administrative personnel should be made and possibly legal action taken. Reclamation recommended that a special agent of the Division of Investigations look into the project operations and

²² Murray L. Crosse to John C. Page, Commissioner, September 19, 1940, 6-9, in RG 115, Entry 7, Box 1137, fld. “Tucumcari: Organization.”

²³ See interviews in RG 115, Entry 7, box 1137, fld. “Tucumcari: Organization.”

the reported infractions by Robinson and Matthews. The recommendation received approval. The investigative agent used Crosse's evidence and gathered some of his own, concluding that "no administrative action appears to be necessary." Mutch continued on as resident engineer, and Robinson and Matthews were only reprimanded for violations of using a government vehicle for personal business and the eight-hour workday law.²⁴ After the Crosse report, no mention was made in project records of major administrative incompetence during the period of construction. The men directing construction were not responsible for wartime materials shortages, infestation of weeds, water seepage, and other problems the project would face.

Before beginning work on the main canal and laterals, Reclamation needed facilities to store materials, repair equipment, and house administrative personnel. On a ten-acre plot of land donated by the city of Tucumcari, mostly unskilled laborers employed by the WPA erected a plainly designed warehouse and garage. The project office building—situated close to city hall—however, featured a distinctly southwestern design. Rather than using adobe bricks, which required considerable skilled labor, the WPA used cinder-concrete block finished in light buff plain stucco to replicate the Spanish-Pueblo Revival style—at a cost of only \$22,612.²⁵

The project also required housing for hundreds of workers and their families. Reclamation and contractors set up camps where workers resided and children went to school. Some laborers found housing in the city. The project was an economic blessing

²⁴ Harry W. Bashore, Acting Commissioner, to Bradley Smith, Director of Division of Investigations, memo, September 27, 1940; John C. Page, Commissioner, to First Assistant Secretary, memo, January 1941[?], in RG 115, Entry 7, Box 1137, fld. "Tucumcari: Organization."

²⁵ "Project History, Tucumcari Project," Vol. 2, 1940, 59, in RG 115, Entry 10, Box 565; A; J. M. Barrett, "WPA Constructs Tucumcari Buildings," *Reclamation Era*, Vol. 31 (November 1941): 292-93.

to businessmen and residents of Tucumcari, but some took advantage of the influx of workers by raising rent prices. According to George Taylor of the Office of Price Administration in Albuquerque, it would be most unfortunate “if a small handful of greedy landlords or merchants should be permitted to give our communities a black eye, and in the long run permanently injure the community instead of advancing through hospitable, fair treatment of these visitors.”²⁶

Conchas Division

Building a canal with a total length of eighty-four miles over uneven terrain was no simple task. It was necessary to pass the canal under a rail line, highway, and numerous creeks; literally dozens of siphons were contracted out and constructed where roads, creeks, and other natural or man-made obstacles blocked the path of the canal. The canal, which would extend through several miles of tunnels, had to be constructed in low-lying ground in order to catch run-off from higher ground, and needed several drainage channels to prevent water logging and salt buildup.²⁷

Before awarding construction contracts, Reclamation did its own pre-construction on the access road along the proposed canal route, several structures at the Conchas Dam camp, and the maintenance and service shops in the city of Tucumcari. Preliminary studies firmed up the proposed route of the canal and work it entailed, in all locating fifty-five miles of canal and 220 miles of laterals and sublaterals.²⁸ On November 16, 1939, Reclamation finally opened the bidding for 21.4 miles of the canal, four miles of

²⁶ Taylor to Earl Grau, June 29, 1944, in RG 115, Entry 7, box 1136, fld. “Clippings Thru Aug. 1944.”

²⁷ Water and Power Resources Service, *Project Data*, 1229; Lee J. Noftzger, “Distribution System, Tucumcari Project, New Mexico,” *Reclamation Era*, Vol. 31 (April 1941), 126; “Project History, Tucumcari Project,” Vol. 3, 1941, 28, in RG 115, Entry 10, Box 565.

²⁸ “Project History, Tucumcari Project,” Vol. 2, 1940, 14-16, 30-32, in RG 115, Entry 10, Box 565.

tunnels, and concrete aggregates used for the concrete structures and tunnel lining. The Utah Construction Company and Griffith Company of San Francisco jointly received the bid for the canal; the contract for the three tunnels went to Jahn-Bressi-Bevanda Constructors, Inc., of Los Angeles for \$1,309,582; and Brown and Root, Inc., of Austin, Texas, received the bid to provide the concrete aggregates. In 1941 Henry Shore received the contract for the construction of the irrigation outlet and stilling basin at the reservoir.²⁹

Each of the contractors set up their own camps near the construction sites. The contractor working on the tunnels selected a site at the outlet of tunnel No. 2 and, in March 1940, began work in earnest, beginning with the shortest of the three, tunnel No. 1. To do the tunnel through the hard rock in the mesa workers used a mucking machine and a track-mounted jumbo. The contractor drilled forty holes then used explosives to clear out the cavity. When drilling hit poor ground—softer rock or an old streambed filled with sand—it took additional time to secure the site and continue with operations. Muckers and rails transported materials in and out with few glitches. Tunnel No. 1 took eighty-five days to bore through 2,596 feet of shale and rock. After excavation, workers lined the tunnels with concrete that Brown and Root, Inc., prepared near the banks of the South Canadian River.³⁰

The contractors began construction of the first 22.3 miles of the canal in San Miguel County in 1940 and completed the work two years later before work slowed to free up resources for wartime production. In fact, in 1942 and 1943 the work ceased

²⁹ “Project History, Tukumcari Project,” Vol. 2, 1940, 14, 43-44; “Project History, Tukumcari Project,” Vol. 3, 1941, 43, in RG 115, Entry 10, Box 565.

³⁰ Robinson, “Tukumcari Tunnel Construction,” 11, 18; “Project History, Tukumcari Project,” Vol. 2, 1940, 48-50, in RG 115, Entry 10, Box 565.

altogether, with the exception of some “canal excavation that will not require strategic war material.”³¹ During the war, it was recommended that the War Food Administration resume work on the Tukumcari Project as a wartime food project. In 1944 the Kiwanis Club of Tukumcari passed a resolution to that effect, and Clinton P. Anderson, representative from New Mexico, delivered strong remarks to the Congress for the same purpose: “We are unable to understand why so many other projects have been approved by the War Production Board while this one, so close to completion, still hangs in the balance.” Shortly thereafter the board gave approval and work once again resumed on the Tukumcari Project.³²

In the years after 1944, several new contracts went to Bressi-Bevanda, Contractors; J. S. Terteling and Sons, Inc.; Clyde W. Wood, Inc.; Lock Joint Pipe Company; J. G. Shotwell; and Lym Engineering Company of Salt Lake City. Up to this time, primarily work on the Conchas Division had been done; now, many of these contracts called for the beginning of work on the Tukumcari Division.³³

Tukumcari Division

By 1945 the main canal was thirty-eight miles long and already serviced 7,000 acres of land via laterals. On the main canal in the Tukumcari Division, good progress had been made on the excavation and siphons before construction stalled in 1943. After the war, Reclamation continued or initiated work on fifty miles of roads, the main canal from mile 39.33 to 61.83, siphons Nos. 24 and 30, Tunnel No. 5, earthworks and

³¹ “Project History, Tukumcari Project,” Vol. 3, 1941, 3, 36, in RG 115, Entry 10, Box 565.

³² Tukumcari Irrigation Project, Extension of remarks by Hon. Clinton P. Anderson of New Mexico, February 29, 1944, in RG 115, Entry 7, Box 1136, fld. “Tukumcari, Clippings, Thru August 1944.”

³³ “Project History, Tukumcari Project,” Vol. 6, 1944, 17, 27; “Project History, Tukumcari Project,” Vol. 7, 1945, 8; “Project History, Tukumcari Project,” Vol. 8, 1946, viii, in RG 110, Entry 10, Box 566.

structures, drainage inlets, and various minor features.³⁴ By the end of 1949 Reclamation had completed or nearly completed the main canal in the Tukumcari Division and appurtenant works.

In late 1944 the Morrison-Knudson Company, Inc., received the contract for the construction of earthwork and Tunnel No. 5 on the Conchas Canal. Early the next year the contractor began excavating the clay- and sand-filled soil using pneumatic spades, drills, and tractors. However, the contractor did not take adequate steps to prevent cave-ins, apparently having failed to heed several warnings and follow the detailed directions handed down by the construction engineer. On September 18, 1945, three days after completing the tunnel excavation, cave-in occurred near station 3148+06, damaging the corner of the Doughty Funeral Home. In 1948, several years after Reclamation accepted as completed the construction of the tunnel, another section of the canal settled, which resulted in damage to the city water and sewer line.³⁵ At first sight the cavity appeared only two feet wide, eight feet long, and twelve feet deep, but it turned out to be ten to fifteen feet wide and fifty feet long. Repair work on that cavity began immediately, but then a second cavity about the same size as the first was found. On April 30, 1948, the unstable trench caved in while three project employees were inspecting the extent of the cavity, burying two of the men completely and killing all three.³⁶

In the official report of the cave-in, Reclamation consulted the records and concluded the tragic episode could not be attributed to “underground flows around the

³⁴ Cost Index Report No. 1–Tukumcari Project, 1944, Sheets 1-2, in RG 115, Accession 8NN-115-85-019, Box 834.

³⁵ “Report of Cave-In, Tunnel No. 5, Tukumcari Project, New Mexico,” March 15, 1949, 1-4, in RG 115, Accession 8NN-115-85-019, Box 835.

³⁶ *Ibid.*, 6-8.

tunnel,” or to “the solubility of soils surrounding the tunnel.” Rather, the cave-in “resulted from failure to properly backfill all areas in which overbreak had occurred during excavation of the tunnel.” Although the Morrison-Knudson Company, Inc., performed the work, Reclamation was also responsible for not ensuring that the work was being done properly and for not ordering the contractor to change the method of backfilling.³⁷

While the main canal required multiple tunnels and siphons through rough terrain, the path the Hudson Canal followed was easier going. From a point between Siphon No. 27 and Siphon No. 28, the canal branched from the main canal and ran northeast over mostly Class 1 or 2 arable lands to the outer reaches of the project area. Reclamation did most of the general surveys on the Hudson Canal in 1940-1943 but did not award contracts for the canal’s construction until 1945.³⁸ Construction companies that received contracts on the Hudson canal included J. A. Terteling & Sons, Inc.; John W. Beam of Denver, for furnishing the radial gate for Wasteway No. 1; D. D. Skousen of Albuquerque for construction of several Hudson drains and laterals.³⁹ Although Terteling & Sons, Inc., encountered a few minor delays in 1947 as a result of poor weather conditions, steel and materials shortage, and a short ten-day work strike by the American Federation of Labor, it was still able to complete the excavation, embankments, and backfill on the Hudson canal and laterals in a timely manner.⁴⁰ In the 1950s, several contracts were awarded for compact earth lining and surface drains. According to the

³⁷ Ibid., 11-12.

³⁸ “Project History, Tukumcari Project,” Vol. 8, 1946, 25, in RG 115, Entry 10, Box 566.

³⁹ “Project History, Tukumcari Project,” Vol. 8, 1946, 25, in RG 115, Entry 10, Box 566; “Project History, Tukumcari Project,” 1948, 10; “Project History, Tukumcari Project,” 1949, 11, in RG 115, Entry 10, Box 567.

⁴⁰ “Project History, Tukumcari Project,” Vol. 9, 1947, 8-10, in RG 110, Entry 10, Box 567.

official project reports, these surface drains were necessary for “the rapid removal of excess surface water so that these will not percolate into the subsoil to build up the water-table or saturate the topsoil with a resultant return of these salt-laden waters.” There were several of them: Drain 3 extended west 1.5 miles to a dry lake and then 2.3 miles to a collection basin near the Benson lateral; Drain 6 was a mile long and also terminated at a collection basin.⁴¹

Throughout the life span of the project, Reclamation coordinated and relied on information provided by other federal and state agencies. The U.S. Department of Agriculture, the Soil Conservation Service, and the state of New Mexico provided useful information on crops, climate, and irrigable land. As it had done in the construction of Conchas Dam and the administrative building in Tucumcari, Reclamation briefly employed WPA relief workers on several miles of the canal in Quay County and on siphon No. 25 across Pajarito Creek, “one of the longest and largest ever built by the Bureau of Reclamation.”⁴²

Begun in 1940 and completed over a decade later, the project carried a price tag of \$15,822,675, nearly double the original projected cost. According to terms of the contract, the district had agreed to repay about a third of that, as well as \$76,426 for the cost of the emergency pumps.⁴³

⁴¹ “Final Construction Report, Hudson Canal Lining, Tucumcari Project, New Mexico,” June 1954, 1, in RG 115, Project Records 1910-55, Box 835; Bert Levine, “Final Construction Report on Drains Nos. 3 and 6, Tucumcari Project, New Mexico,” March 1953, 3-4, in RG 115, Accession 8NN-115-85-019, Box 836.

⁴² “Project History, Tucumcari Project,” Vol. 2, 1940, 20; “Project History, Tucumcari Project,” Vol. 3, 1941, 22, 46, in RG 115, Entry 10, Box 565.

⁴³ U.S. Department of Interior, Bureau of Reclamation, “Plan for Regulating Reservoir, Tucumcari Project, New Mexico,” August 1954, 2, in RG 115, Project Reports 1910-55, Box 835.

Post-Construction History

The Corps continued to operate and maintain Conchas Dam, but Reclamation, as was standard practice, turned over operation and maintenance of irrigation facilities to the conservancy district. Before January 1, 1954, the project had been jointly operated from the administrative building in Tucumcari; after that time the conservancy district assumed full O&M responsibility for the project. Around the same time, the New Mexico State A&M College took over the irrigation experiment station that had been constructed and operated by Reclamation.⁴⁴

During construction, Reclamation had publicized the project through newspaper, radio, and pamphlets distributed by the Tucumcari Chamber of Commerce, and it had established programs designed to ensure its success. On a demonstration farm, for instance, Reclamation planted grain, alfalfa, pasture, corn, beans, potatoes, and grass as a test run for potential production and trees to be used for wind breaks to provide “some protection for the light soils of the area.” Farmers received water-saving advice from irrigation experts who recommended irrigating only as deep as the roots and only when plants needed it—rather than by the calendar.⁴⁵

Reclamation and the district also confronted problems with communication, woody plants, weeds, and water seepage. Relaying information from project headquarters to farmers in the field had always been a problem. At Tucumcari, however, Reclamation installed a radio-telephone line, which connected the headquarters to six field stations. The benefits of this system were many, according to superintendent Ray

⁴⁴ Willis C. Boegli, “The Tucumcari Transfer,” *Reclamation Era*, Vol. 40 (May 1954): 27-8.

⁴⁵ “Project History, Tucumcari Project,” Vol. 5, 1943, 60, in RG 115, Entry 10, Box 566; “Project History, Tucumcari,” Vol. 9, 1947, 53; “Project History, Tucumcari,” Vol. 10, 1948, 7, in RG 115, Entry 10, Box 567; “Better Irrigation Essential for the Growing of War Time Crops,” *Tucumcari American*, July 26, 1944, in RG 115, Entry 7, Box 1136, fld. “Tucumcari, Clippings Thru Aug. 1944.”

Lyman: “If a farmer sees his crop is burning and decides he needs water immediately, he can check the Bureau [of Reclamation] office, obtain authority for his water, and have it on the way to his farm in a matter of hours. Formerly, days sometimes elapsed before the water could be sent on its way in some parts of the project.”⁴⁶

Then there was the challenge of clearing lands “infested” with mesquite before they could be irrigated. Normally, farmers employed primitive methods to clear the land, usually by tearing it up by hand or burning it with kerosene. At Tucumcari, however, they used the latest machinery—the root-cutting machine—to tear up the mesquite at its roots and to level the ground. Reportedly, a La Plante Choate pull plow could tear up the mesquite at the roots without disturbing the natural grass sod. After cutting, it racked up the brush for burning. This process of cutting, gathering, and burning was estimated at \$10 per acre was done on several thousand acres of project land.⁴⁷

Noxious weeds, too, posed a problem for project personnel and farmers. Reclamation officials wrote articles on weed control that appeared in the *Tucumcari Daily News* and the *Tucumcari American*. They also tried to educate locals about the problem—for instance, W. H. Mercer gave public demonstrations and talks on controlling the bindweed (also known as vine weed or morning glory) and answered questions “about mixing the spray, quantities used, time required for killing, the occasional need for respraying, the effect of spray on farm crops, grasses and shrubs.”⁴⁸ Waging a “war on weeds,” jointly coordinated by local, state, and federal efforts, the Noxious Weed Control Committee began eradication of bindweed in the spring of 1946.

⁴⁶ Garford L. Wilkinson, “Calling All Ditchriders,” *Reclamation Era*, Vol. 35 (Feb. 1949): 45.

⁴⁷ “Machines Against Mesquite,” *Reclamation Era*, Vol. 32 (July 1946): 142-3; “Root Ripper Wreaks Havoc on Mesquite,” *Tucumcari Daily News*, January 3, 1945, in RG 115, Entry 7, Box 1136.

⁴⁸ D.D. Suggs, “‘W-Day’ at Tucumcari,” *Reclamation Era*, Vol. 33 (May 1947): 111-12.

The committee began within the city boundaries, spraying the weeds with one-tenth percent solution of the chemical 2, 4-D. The first spraying in 1946 was a success—about ninety percent effective—but the initial efforts were a mere prelude to the perennial threat of noxious weed infestation. The next year, on August 6, the committee injected Benoclor 3-c in the canal water at the inlet to kill submersed aquatic weeds, but a weed jam in the canal at Jack County Creek resulted in a two-day delay and the loss of about 60-80 acre feet of water. The district continues to control bindweed, Johnson grass, and other weeds and woody plants on an annual basis.⁴⁹

Of primary concern was the loss of canal water from seepage. Since water from the reservoir traveled long distances along mostly unlined canals and laterals to project lands, some water loss was inevitable, but the actual water losses were greater than anyone anticipated. The impact of seepage on the water table was phenomenal. Whereas in the 1940s heavy pumping of city wells lowered the water tables creating a 36,000 acre-foot cone of depression, after that time seepage and irrigation return flows not only brought the table up but completely filled in the depression. However, this water was poor quality and not potable. Moreover, the water that had raised the water table was desperately needed by farmers.⁵⁰

Reclamation planned several projects to either mitigate or reduce the water losses. In 1954 it proposed the construction of a regulating reservoir midway down the canal. As explained in the official report, “variations in canal loss due to water depth, the length of

⁴⁹ Suggs, “‘W-Day’ at Tucumcari,” 112; “Project History, Tucumcari Project,” Vol. 9, 1947, front piece, ix, in RG 115, Entry 10, Box 567; “Project History, Tucumcari Project,” 1957, 5, in RG 115, Entry 10, Box 568.

⁵⁰ J. Phillip King, John W. Hawley, John Hernandez, John F. Kennedy, Eluid L. Martinez, *Study of Potential Water Salvage on the Tucumcari Project Arch Hurley Conservancy District*, New Mexico Water Resources Research Institute, June 2006, 36.

time element involved in the traveling water, conditions of channel, weather, etc., often cause the most carefully prepared estimates of use being in substantial error, resulting in frequent inadequate delivery or heavy waste.” With a capacity of 860 acre feet, it was considered sufficient to bring the supply and demand into harmony, but the proposal was never implemented.⁵¹ In 1967, and again in 1971, Reclamation looked into the possibility of installing higher crest-gates on Conchas Dam. This no doubt would have reduced the loss of water during periods of high flow, but they were never built because of potential damage to structures and facilities at the lake and because the additional storage would not add much to the project supply.⁵²

In the 1980s the conservancy district and the Bureau of Reclamation recommended lining the canals. In its 1981 report the district surveyed the banks of the main canal and nearby land for evidence of seepage, concluding that cottonwoods and native grasses were mostly to blame for the high levels of transpiration and evaporation. It recommended lining the canal on sixteen reaches—a total of 10,000 feet on the main canal north of State Highway 104 and 6,000 feet on the canal within project lands. In its 1983 study Reclamation added to the district’s conclusions by modifying the length of the reaches and recommending five additional sites where leakage was a problem. In all, it recommended lining 25,250 feet of the canal.⁵³

According to a 2005 study, the cost of “saving” 12,600 acre feet of water from the Main Conchas Canal being lost to seepage was about twenty-five million dollars, or about \$2,000 per acre foot of water saved. Further reduction of seepage at an estimated

⁵¹ U.S. Department of Interior, Bureau of Reclamation, “Plan for Regulating Reservoir, Tukumcari Project, New Mexico,” August 1954, 11, in RG 115, Project Reports 1910-55, Box 835.

⁵² King, et al., 37.

⁵³ Ibid., 37-39.

cost of \$500 to \$1,000 per acre foot could be accomplished by lining laterals within the irrigation district. To date, however, the canals on the Tukumcari Project have never been lined because of financial constraints.⁵⁴

Project Benefits

In 1946 the distribution system delivered water to 7,000 acres of project farmland; in 1955 that number jumped to 33,616 acres. The project never provided water to more than about 34,000 acres of land in the Tukumcari area, all within Quay County, despite an original projection of 45,000 acres.⁵⁵

We know something of the people who initially settled the project lands through Reclamation's monthly periodical, *Reclamation Era*. Henry Batterman, who prior to becoming a farmer was a laborer and machinist, nearly paid off the price of his farm at Tukumcari after only one growing season. D. C. Atwood, a cotton farmer from Oklahoma, regained his spirits and health after settling on his farm where he grew cotton. No longer did he distress about whether rain would fall to water his crops. The project promised a secure water supply, relieving farmers like Atwood from worrying about when the next rains would come.⁵⁶ The periodical also predicted that hundreds of other "land-hungry families" would make their way to Tukumcari and experience similar successes, but we know much less about them and their stories.

Other families no doubt did come, but they faced their share of obstacles. A few settlers, like Atwood, grew cotton and other crops not as well suited for the arid desert climate. Others had little or no experience in irrigation farming and lacked the necessary

⁵⁴ Ibid., iv; see also Franklin McCasland, conversation with the author, April 21, 2008.

⁵⁵ "Project History, Tukumcari Project," 1955, 5, 29, in RG 115, Entry 10, Box 565.

⁵⁶ Garford L. Wilkinson, "The People," *Reclamation Era*, Vol. 33 (April 1947): 73-5, 83.

capitol for start-up costs. Even with the new mechanical cutters, preparing the land for production was beyond the means of some farmers. Moreover, farm loan agencies were hesitant to loan money to farmers on land that had so recently been put into production.⁵⁷

A major problem for many farmers was uncertainty—uncertainty about the climate, pests, price of produce, and, even, water supply. In 1950 Tucumcari Project farmers received 11.28 inches of rain in July but then experienced an unusually dry August, followed by below-normal temperatures in September. The heavy rains slowed growth of crops yet provided ideal conditions for weeds; the dry month required heavy irrigation yet in some cases crops withered before water could reach them. Other factors, like insect pests and disease, produced a poor crop of only \$35.18 per acre. In 1951 the crop yielded an average of about \$60 per acre, \$24 above the year before, but unusually warm weather and presence of the web worm curtailed production of sugar beets.⁵⁸ Ironically, the very thing that the project was supposed to provide—a reliable supply of water—became the paramount concern. Existing farm owners usually received enough water to produce a good crop, but because of seepage there was less total irrigated acreage than originally anticipated. As the project history noted in 1956, “there appears to be little incentive for the development of additional irrigable land until the project water supply improves.”⁵⁹

In recent years, concern over water supply has taken a more serious turn due to an on-going drought since 2002. According to the manager of the Arch Hurley Conservancy

⁵⁷ “Project History, Tucumcari Project,” 1951, Section B-Ch. 4, in RG 110, Entry 10, Box 567; “Project History, Tucumcari Project,” 1957, Economic Analysis, 4, in RG 110, Entry 10, Box 568.

⁵⁸ “Project History, Tucumcari Project,” 1950, Section B-Ch. 4, “Project History, Tucumcari Project,” 1951, Section B-Ch. 4, Appendix: Narrative Report, in RG 110, Entry 10, Box 567.

⁵⁹ “Project History, Tucumcari Project,” 1956, 3, RG 115, Entry 10, Box 568.

District, Franklin McCasland, drought conditions and the loss of about half the project water to seepage present a hardship for farmers. The district is careful to deliver water to the most productive lands available and to remove woody plants and weeds on an annual basis. Many farmers have switched from ditch to sprinkler irrigation and now produce mostly alfalfa because of the high demand for livestock feed in the area. The Arch Hurley Conservancy District's 2007 crop census reports 14,759 acres irrigated.⁶⁰

Conclusion

Although initially conceived in the early twentieth century, the Tukumcari Project was a child of the crisis of depression and unemployment in the 1930s, since it was conceived in large part, according to J. M. Barrett, "to relieve a rather acute unemployment situation in Tukumcari, N[ew] Mex[ico], and the surrounding counties."⁶¹ Not only did the project provide work-relief jobs, however, but it afforded the possibility of a new life for hundreds of small-landed farmers. Some of these farmers made a good living on project lands, though hardship was common and the project in general was not as successful as hoped. Today, the lands continue to be productive and efforts continue to find cost-effective and efficient methods to minimize water losses.

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⁶⁰ Franklin McCasland, conversation with the author, April 21, 2008; Tammie Padilla of Reclamation's Albuquerque Area Office, email to author, May 1, 2008.

⁶¹ Barrett, "WPA Constructs Tukumcari Buildings," 292.

Bibliography

Manuscript and Archival Collections

Record Group 115. Records of the Bureau of Reclamation. Entry 10. "Project Histories, Tucumcari Project." Vols. 1-4, 1939-42, Box 565. Vols. 5-8, 1943-46, Box 566. 1947-55, Box 567. 1956-60, Box 568. National Archives and Records Administration, Denver, Colorado.

Record Group 115. Records of the Bureau of Reclamation. Accession 8NN-115-85-019. Project Reports, 1910-55. Boxes 834-836. National Archives and Records Administration, Denver, Colorado.

Record Group 115. Records of the Bureau of Reclamation. Entry 7. Project Correspondence, 1930-45. Boxes 1136-1137. National Archives and Records Administration, Denver, Colorado.

Government Documents

United States Department of the Interior, Bureau of Reclamation, National Park Service, and United States Department of the Army, Corps of Engineers. *The History of Large Federal Dams: Planning, Design and Construction*. By David P. Billington, Donald C Jackson and Martin V. Melosi. Denver: Bureau of Reclamation, 2005.

United States Department of the Interior, Water and Power Resources Service. *Project Data*. Denver: United States Government Printing Office, 1981.

Non-Government Reports

Jensen, R., C. Hart, M. Mecke, and W. Hatler. *The Influence of Human Activities on the Waters of the Pecos Basin of Texas*. TWRI technical report SR-2006-03, 2006.

King, J. Phillip, John W. Hawley, John Hernandez, John F. Kennedy, and Eluid L. Martinez. *Study of Potential Water Salvage on the Tucumcari Project Arch Hurley Conservancy District*. New Mexico Water Resources Research Institute, June 2006.

Secondary Sources

- Barrett, J. M. "WPA Constructs Tuumcari Buildings." *Reclamation Era*. Vol. 31 (November 1941): 292-3.
- Boegli, Willis C. "The Tuumcari Transfer." *Reclamation Era*. Vol. 40 (May 1954): 27-8.
- "Conchas Dam and Proposed Tuumcari Project." *Reclamation Era*. Vol. 29 (June 1939): 126-30.
- "Flood on the South Canadian River, in Oklahoma and Indian Territory, October 1-4, 1904." *Monthly Weather Review*. (November 1904): 522.
- "Machines Against Mesquite." *Reclamation Era*. Vol. 32 (July 1946): 142-3.
- Mutch, H. W. "Preconstruction Investigations—Tuumcari Project, New Mexico." *Reclamation Era*. Vol. 30 (September 1940): 270-72.
- Noftzger, Lee J. "Distribution System, Tuumcari Project, New Mexico." *Reclamation Era*. Vol. 31 (April 1941): 125-6.
- Ortiz, Alfonso, editor. *Southwest*, Vol. 9, of *Handbook of North American Indians*, William C. Sturtevant, editor. Washington, D.C.: Smithsonian Institution, 1979.
- Robinson, H. E. "Tuumcari Tunnel Construction." *Reclamation Era*. Vol. 32 (January 1942): 11.
- Suggs, D. D. "'W-Day' at Tuumcari." *Reclamation Era*. Vol. 33 (May 1947): 111-12.
- Wilkinson, Garford L. "Calling All Ditchriders." *Reclamation Era*. Vol. 35 (February 1949): 45.
- . "The People." *Reclamation Era*. Vol. 33 (April 1947): 73-5, 83.
- Woodward, John P. "Tuumcari's Champions." *Reclamation Era*. Vol. 33 (August 1947): 183.

Internet Sources

- "Arch Hurley Water Users." <http://www.archhurley.com/>.
- "Tuumcari, New Mexico." Wikipedia. <http://en.wikipedia.org/wiki/Tuumcari>.

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